STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-A_/

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Type I Progress Report
ERTS-A

(A) Studies of the Inner Shelf and Coastal Sedimentation Environment of the Beaufort Sea from ERTS-A

ERTS-A Proposal No.: SR 206 Subdisciplines: 3I, 4C, 5B, 5E, 5F, 5G, 5H, 7D.

(B) GSFC ID No. of P.I.: IN 394

(C) Open season studies at the test site commenced on July 15th, and extended into the middle of September, well after the first ERTS-1 imagery had been received. Because of the remoteness of the study area, we did not have access to ERTS-1 data until after the fieldwork was completed.

(D) An extensive program of field studies was carried out by personnel of the USGS in the test site area during the open season, extending from the middle of July to the middle of September. Up to nine scientists and technicians, using three different vessels, were in the area at a given time.

The 40-ft Research Vessel LOON of the USGS, with Erk Reimnitz as chief scientist, started operating in the nearshore zone on July 16th. Geophysical studies, water measurements, and ice observations were made during the following 3 weeks while the sea ice gradually broke up. A fathometer, high-resolution seismic system, and a side-scanning sonar system were operated simultaneously along tracklines covering the inner shelf. The seismic records serve to delineate thickness and distribution of Holocene sediments; the sonar records

show the effects of ice gouging on the sea floor. The trends of ice gouges should reflect the dominant direction of pack ice movement, and this will be correlated with ERTS-1 imagery. Measurements of salinity, temperature, and turbidity of sea water were made routinely along the tracks. These parameters seem to show distribution patterns and changes related to ice breaking and pack ice movement, as well as river discharge.

Tasks accomplished during succeeding weeks included the following:

(1) Occupied 150 sediment-sampling stations.

(2) Measured water salinity, temperature, and turbidity.

(3) Measured current flow.

(4) Monitored ice distribution and movement.

(5) Occupied 40 dive sites in order to study bottom sediment and bottom features, and processes related to ice gouging and the draining of river water from the fast ice.

(6) Studied beaches and shoreline.

(7) Ran close-rid bathymetry of a typical nearshore region with ridges and troughs, backed up by diving studies to learn about the relationship to ice shove.

(8) Made seismic refraction measurements on barrier islands to study depth to permafrost.

(9) Monitored beach changes and processes related to ice via time-lapse photography.

The Coast Guard Cutter GLACIER, with four USGS scientists and technicians under the leadership of Peter Barnes, operated on the outer continental shelf from August 2nd to September 13. High-resolution seismic and side-scanning sonar gear was towed whenever ice conditions permitted, in order to extend coverage to the shelf break. Sediment samples were collected so as to fill gaps in a sampling grid from previous years. The composition of the sediments will be analyzed, providing basic data on the content of organic material and the natural occurrence of copper, lead, zinc, mercury, and arsenic. The transport of suspended particulate matter in the water was observed from the air, using Coast Guard helicopters, in order to correlate with the ERTS-1 imagery. Another topical study was concerned with the transport of sediment by ice. There is very little evidence for modern ice rafting of sediments in the Beaufort Sea. Small amounts of fine-grained sediment observed in the ice could be the result of wind transport. Late in the season, when river discharge is low, aerial observations show higher concentrations of suspended matter on the inner open shelf than inside of the lagoons. Side-scanning sonar records show ice gouges to a shelf depth of at least 150 ft.

The Research Vessel NATCHIK of the Naval Arctic Research Laboratory at Barrow, Alaska with one scientist from the USGS and another from the U.S. Coast Guard, collected sediment and water samples in the study area, and measured water salinity, temperature

and turbidity, as well as current velocity.

Analysis of data collected during the season has begun. Preliminary inspection of some ERTS-1 images promises to provide the synoptic coverage needed to interpret data collected on the ground. In the analysis, data pertaining to the distribution, movement, and seasonal changes in water masses are given first priority.

(E) An extensive field program, using three vessels, and helicopters, was carried out at the test site during the open season (mid-July to mid-September). The studies covered the region between the continental slope and the lagoons and coastline. High-resolution seismic studies aid in delineating areas of modern sedimentation. Side-scanning sonar and bathymetric surveys show linear depressions caused by ice scraping the sea floor. The general direction of ice movement is westerly, roughly parallel to the coast. Sonar records also show scour craters related to the draining of river overflow from the shorefast ice. Measurements of water salinity, temperature, and turbidity show very pronounced seasonal changes related to the interaction between river discharge, ice distribution, melting, and movement. Current-flow measurements, water and sediment samples, and 40 dives using SCUBA-techniques, as well as aerial observations and photography, provide a better understanding of the sedimentary environment of the Beaufort Sea shelf. Several ERTS-1 images

received so far promise to be extremely useful in this study.

Subdisciplines: 3I, 4C, 5E, 5F, 5G.

(F) Reimnitz, Erk, and Peter Barnes, (in press), Sea ice as a geological agent affecting the margin of the Arctic Ocean, Alaska (abst.), to be presented at the AGU "Symposium on Sea-Air Interaction in the Polar Regions" in San Francisco in December 1972.

Barnes, Peter, and Erk Reimnitz (in press), River overflow onto the Sea Ice off the Northern Coast of Alaska, Spring 1972 (abst.), to be presented at the annual AGU meeting to be held in San Francisco in December 1972.

(G) Direct contact between ERTS-1 data center and parties involved in marine research and navigation in the Arctic Ocean, enabling prompt relay of ice information as received from the ERTS-1 satellite, would be extremely useful. Inspection of the first imagery received shows that certain critical regions which from the ground appeared inaccessible to our research vessels, could in fact have been reached for studies.

(H) No changes

(I) None

(J) None

(K) N/A